

# **CALIFORNIA HEAVY DUTY TRUCK TRAVEL SURVEY**

**ON SELECTED SITES**



**DECEMBER 2001**

CALIFORNIA HEAVY DUTY  
TRUCK TRAVEL SURVEY  
ON SELECTED SITES

GOVERNOR GRAY DAVIS  
STATE OF CALIFORNIA

MARIA CONTRERAS-SWEET, SECRETARY  
BUSINESS, TRANSPORTATION AND HOUSING AGENCY

JEFF MORALES, DIRECTOR  
DEPARTMENT OF TRANSPORTATION

DIVISION OF TRANSPORTATION SYSTEM INFORMATION  
OFFICE OF TRAVEL FORECASTING AND ANALYSIS  
STATEWIDE TRAVEL ANALYSIS BRANCH

DECEMBER 2001

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## **- EXECUTIVE SUMMARY -**

### **PURPOSE OF STUDY**

The overall goal of the Heavy Duty Truck Travel (HDT) Survey was to collect representative truck travel data for selected sites in California. An integral aspect of the project was a literature search and inventory study of freight data survey collection methods. Additional study objectives included 1) Development of procedures to acquire basic truck travel data 2) Actual conduct of data collection, 3) Collection of data useful to the identification of relationships between economic activity and truck travel patterns, and 4) Collection of data for analysis of commodity flow throughout California.

### **METHODOLOGY**

To achieve the objectives outlined above; data was collected on the following items through direct, in-person interviews with truck drivers.

- Freeway/Route Traveled
- Direction of Travel
- Interview Facility Location
- Truck Type
- Truck Body Style
- Number of Axles
- Gross Vehicle Weight
- Percent Full
- Primary Commodity Carried
- Last Stop Location
- Last Stop Facility Type
- Last Stop Activity (load/unload)
- Last Stop Departure Time
- Next Stop Location
- Next Stop Facility Type
- Next Stop Activity (load/unload)
- Next Stop Arrival Time
- Distance From Last to Next Stop
- Total Number of Stops for Day
- Total Distance Traveled for Day
- Last State for Refueling
- Presence of Hazardous Material Sign

The survey data collected took place through assisted interviews of 8,287 truck drivers at a total of 33 sites throughout the state. The sites included California Highway Patrol weigh stations, agricultural inspection stations and roadside rest areas.

The interviews were conducted over the busiest periods of the day for each site, ranging from eight to sixteen hours based on the site's hours of operation and traffic volume. To expand the data to a 24-hour time period, videotaping was conducted over a full 24 hours at each of these locations. Since the amount of data that can be collected by video is limited to what can be observed, the 24-hour video data was comprised solely of truck type, truck body style, and number of axles for each observed vehicle.

A project team incorporating a wide range of expertise, practical experience and resources was assembled to achieve the objectives of the study. Project team members included Strategic Consulting & Research, Cambridge Systematics, K.T. Analytics, and ATD Northwest.

A Technical Advisory Committee comprised of members from various Caltrans Divisions and District offices, the California Highway Patrol, several Metropolitan Planning Organizations, the Air Resources Board, the California Energy Commission, the Federal Highway Administration, and the California Trucking Association guided the consultant team.

The project was conducted in five stages that included a literature search, sampling design, survey instrument design, data collection, and reporting.

## **RESULTS**

Overall, the results from the HDT survey addresses the objectives defined for the project. These results are useful for regional and system planning and provide a foundation to expand heavy-duty truck travel data collection activities for forecasting purposes. The results also provide, specifically, the following statistical abstract information on selected state highway routes between four major metropolitan regions in California:

- Descriptions of HDT travel activities by truck body type, geographic area, axle group and other factors.
- Descriptions of travel patterns and trip definitions based on last/next stop information, trip time, and trip distance.
- Percent of heavy-duty truck travel between and within the four major metro regions.
- Percent of truck travel activity by axle groups.
- Percent of truck weight by cargo type.
- Percent of last/next stop by type of facility (e.g. port, rail facility, truck terminal, etc.).
- Distance traveled in and between most recent and next stop.

Collection of statewide heavy-duty truck travel activity by intercept survey represents several challenges. California maintains about 15,200 miles of state highways with a truck population in excess of 661,000 vehicles. Potential exists for double counting on some routes, and missing counts on others. In order to obtain enough data to provide complete origin/destination tables for forecasting purposes, a more comprehensive survey will be needed to enhance the results presented in this report.

## ACKNOWLEDGEMENTS

Strategic Consulting & Research served as the prime contractor for this project. Strategic Consulting & Research managed all field data collection activities, survey design, geocoding, data analysis and overall project management.

Cambridge Systematics conducted the Literature Search and Inventory study for this project, as well as, the Site Selection Plan and Recommended Model Design Plan.

K. T. Analytics provided statistical expertise in the overall development of the Site Selection Plan and in analysis of results.

**The Project Team greatly appreciates the outstanding cooperation and support of the California Highway Patrol in the conduct of this study.**

This survey project was sponsored by: Division of Transportation System Information – Office of Travel Forecasting and Analysis – Statewide Travel Analysis Branch.

Project funding was provided by the California Department of Transportation.

## **Summary of Survey Data, Charts**

The following charts, A through M, will illustrate the survey data weighted and expanded according to the total truck counts recorded by the video camera.

It should be noted that those trucks that travel on routes not covered by the interviewing locations would not be included in these totals. Without a completely exhaustive coverage of the state, it is likely that there is additional truck travel that has not been included in this survey and consequently in the following charts.

Chart A: Truck Type

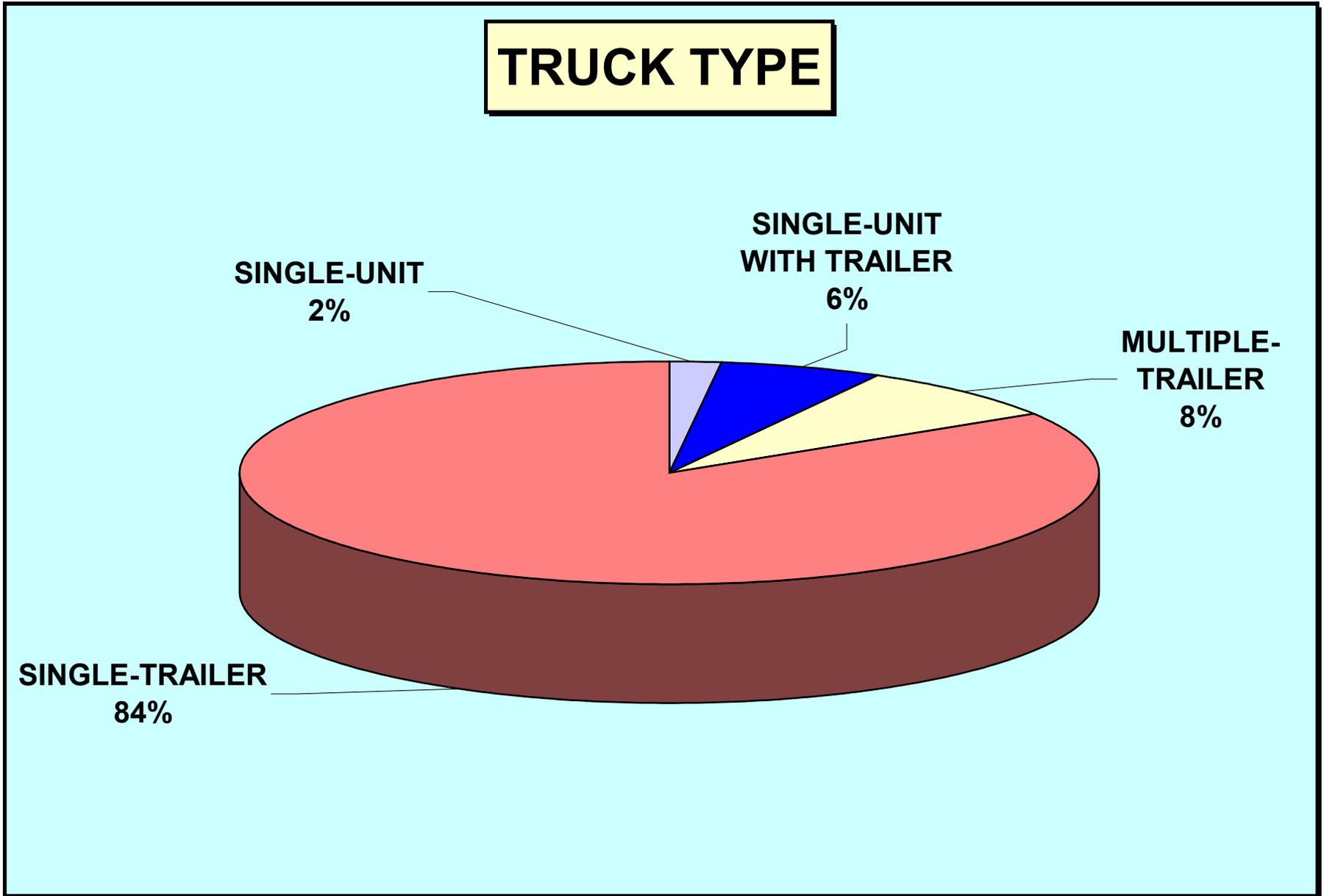


Chart B: Truck Body

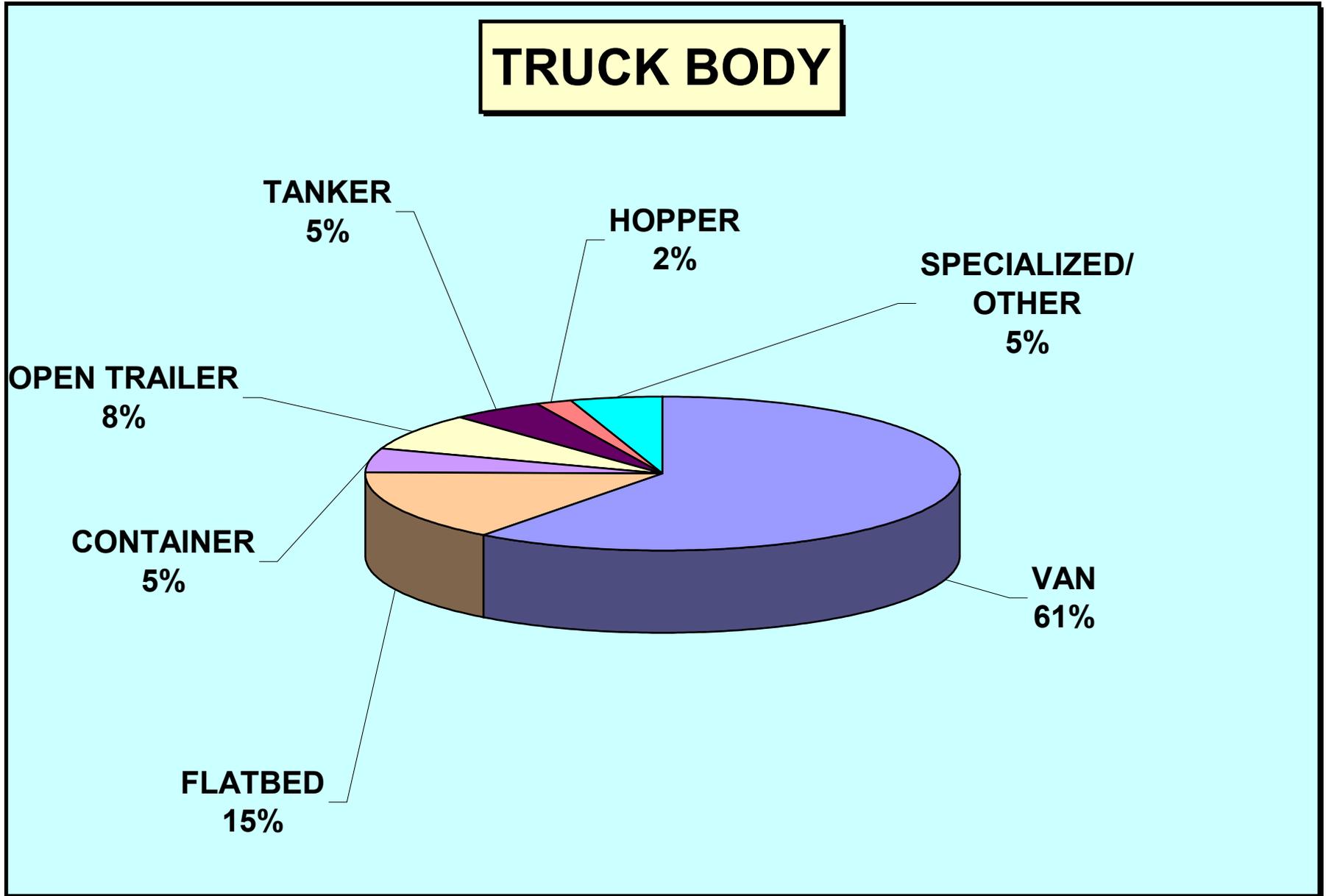


Chart C: Number of Axles

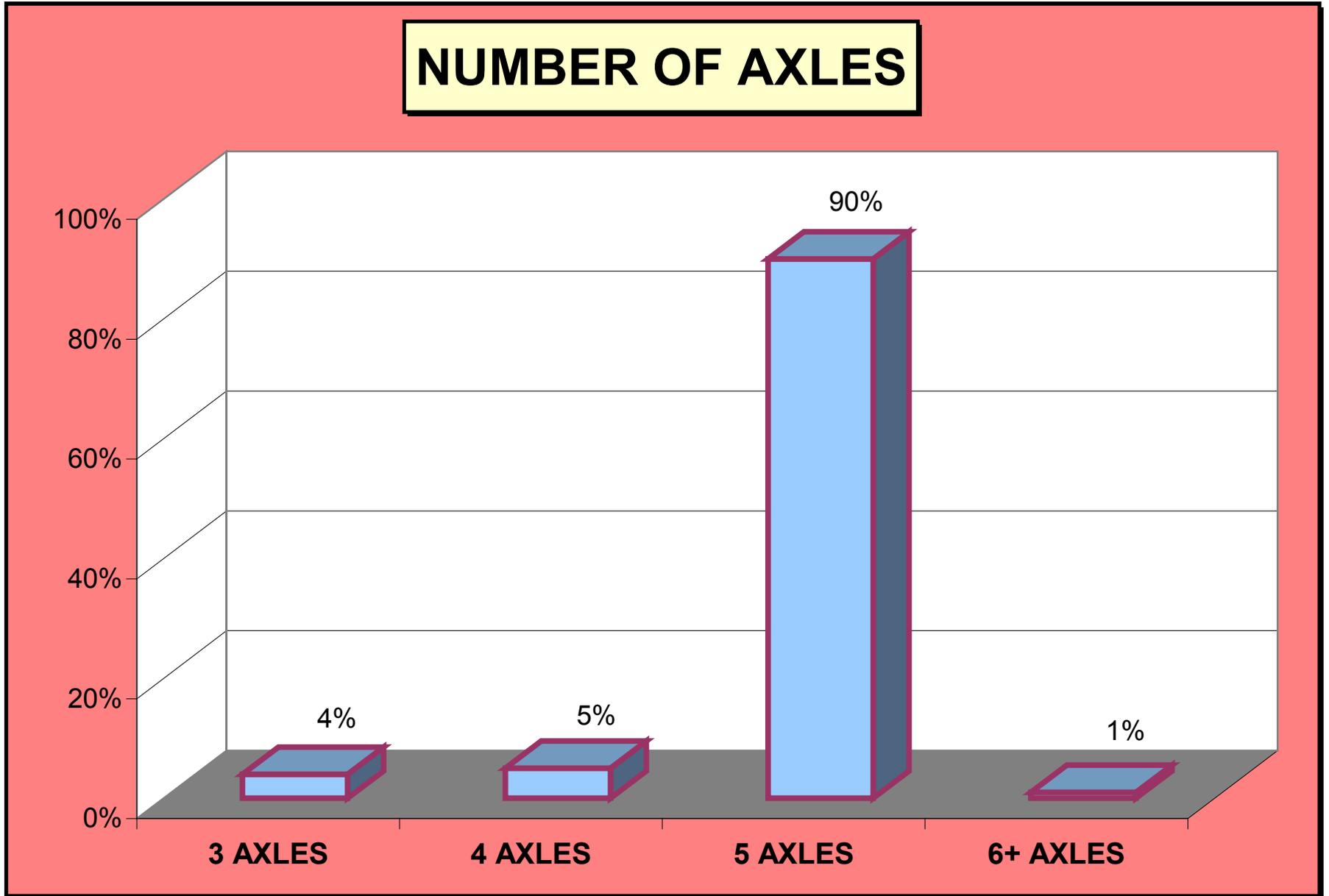


Chart D: Truck Weight

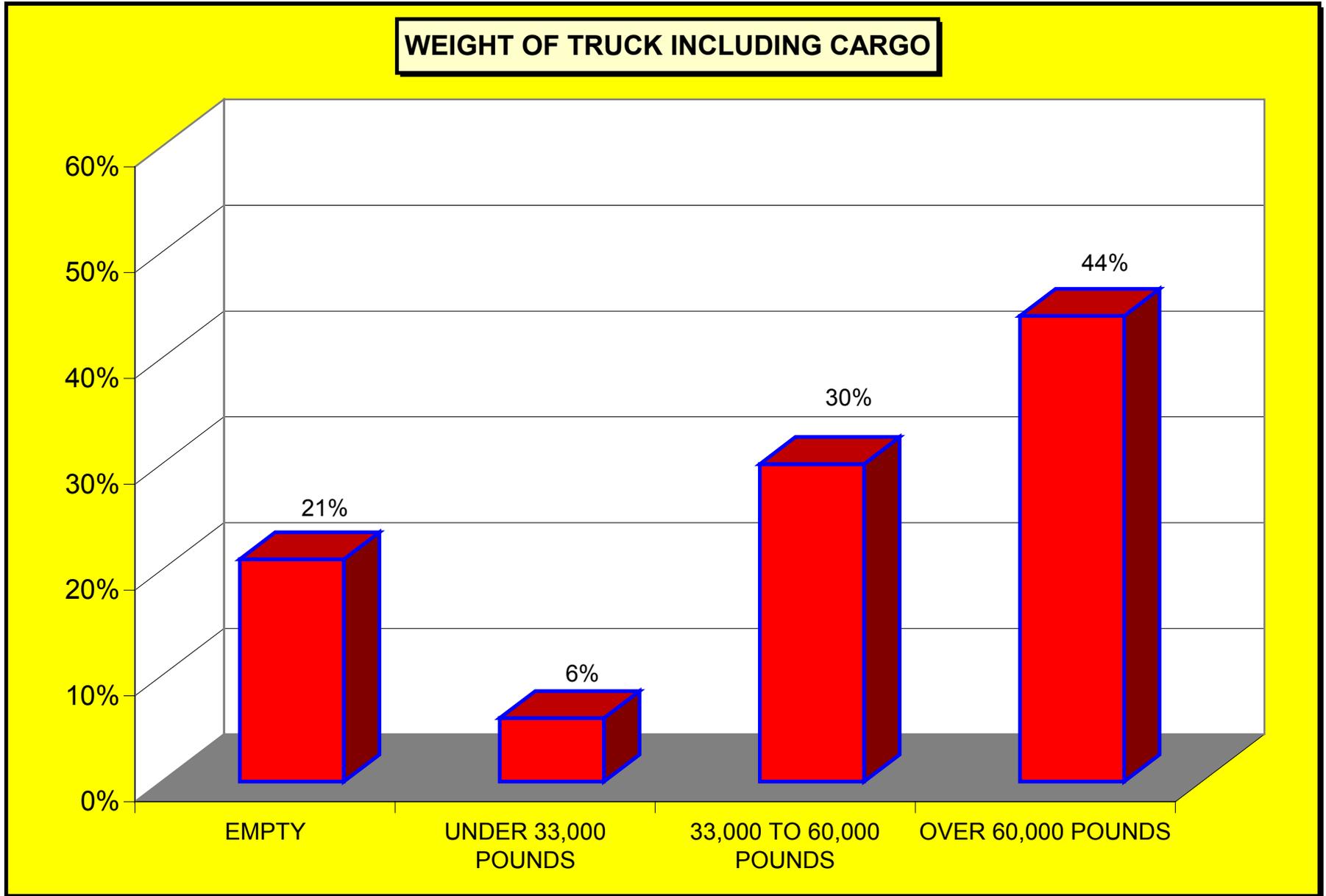


Chart E: Last Stop Facility Type

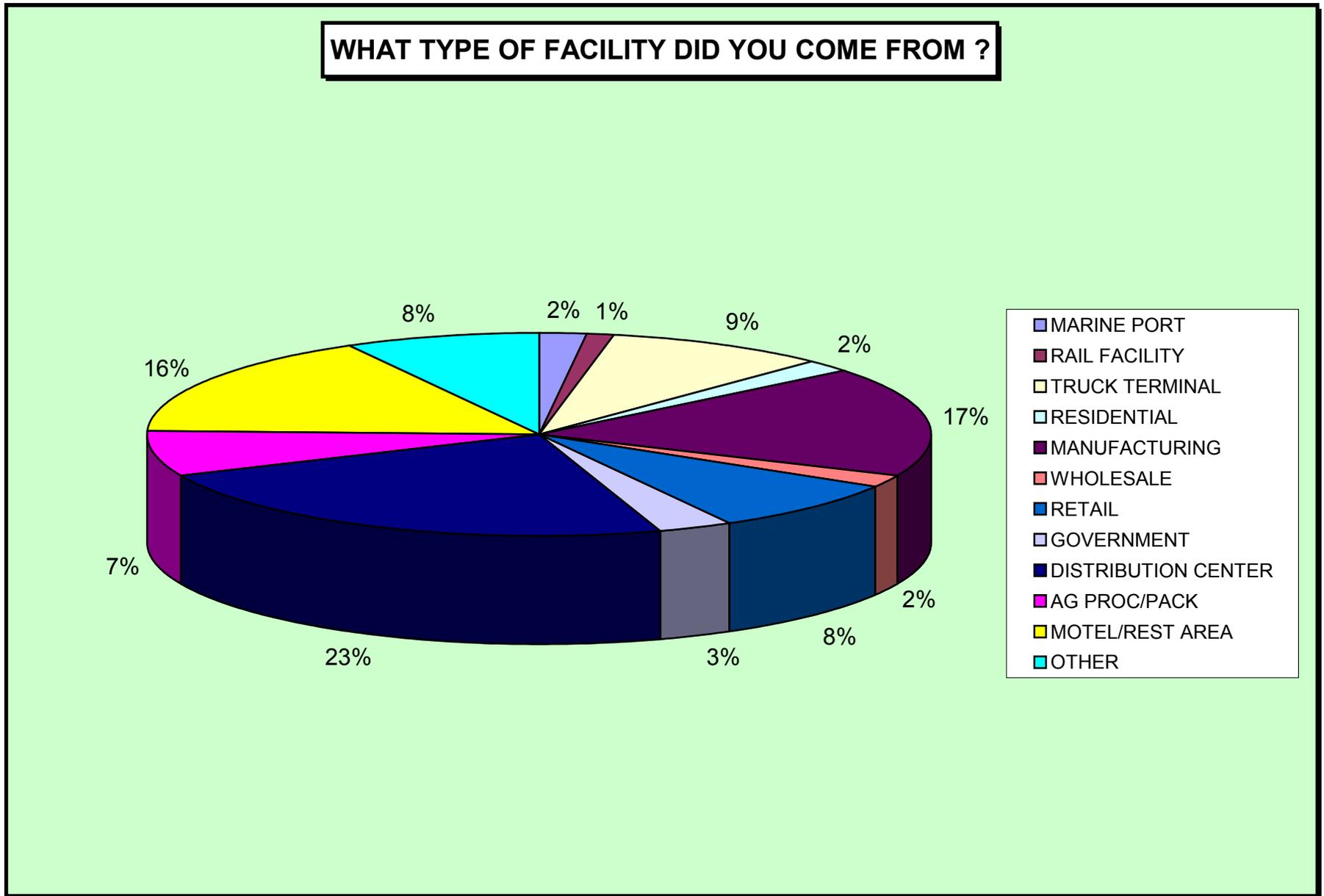


Chart F: Last Stop Activity

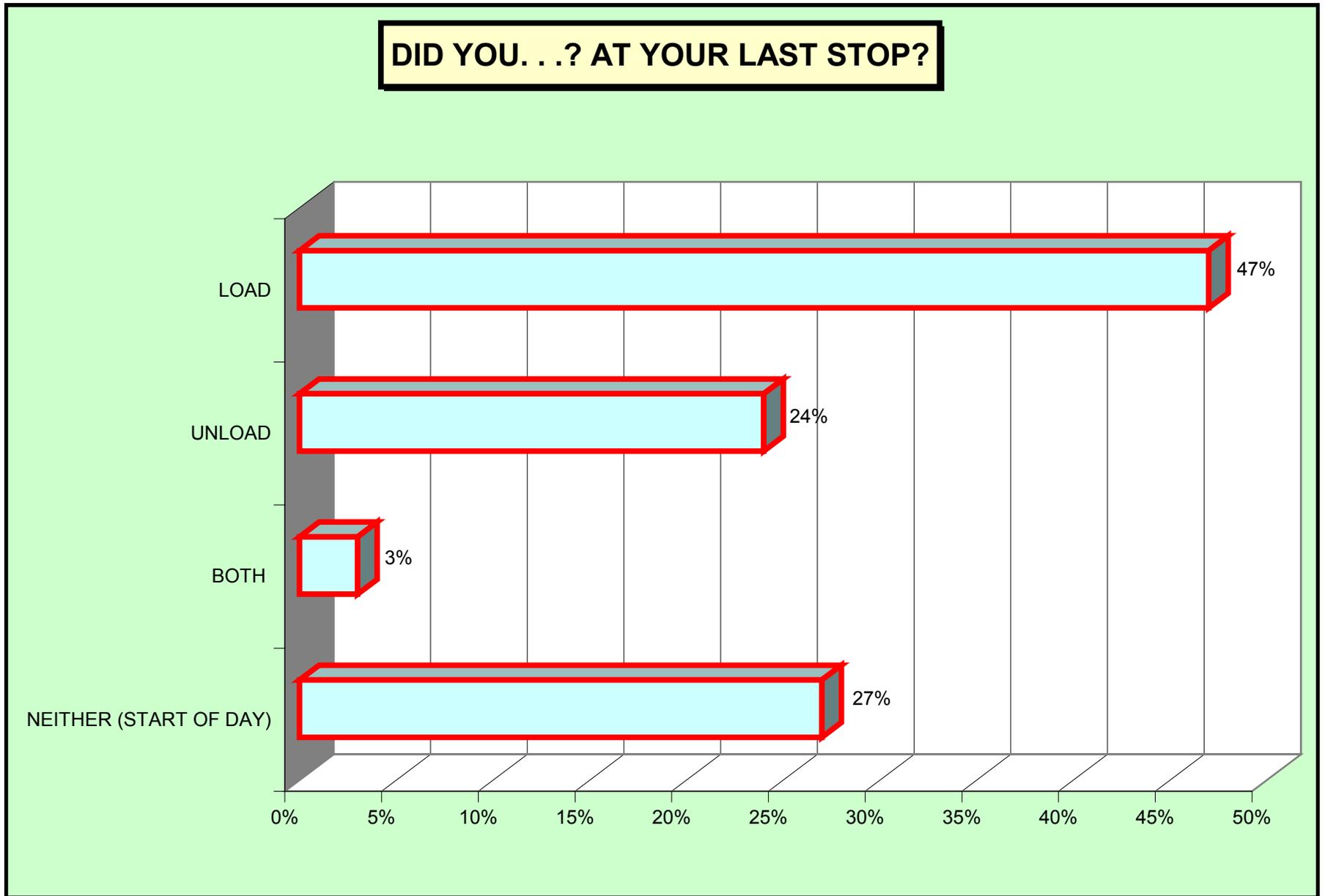


Chart G: Next Stop Facility Type

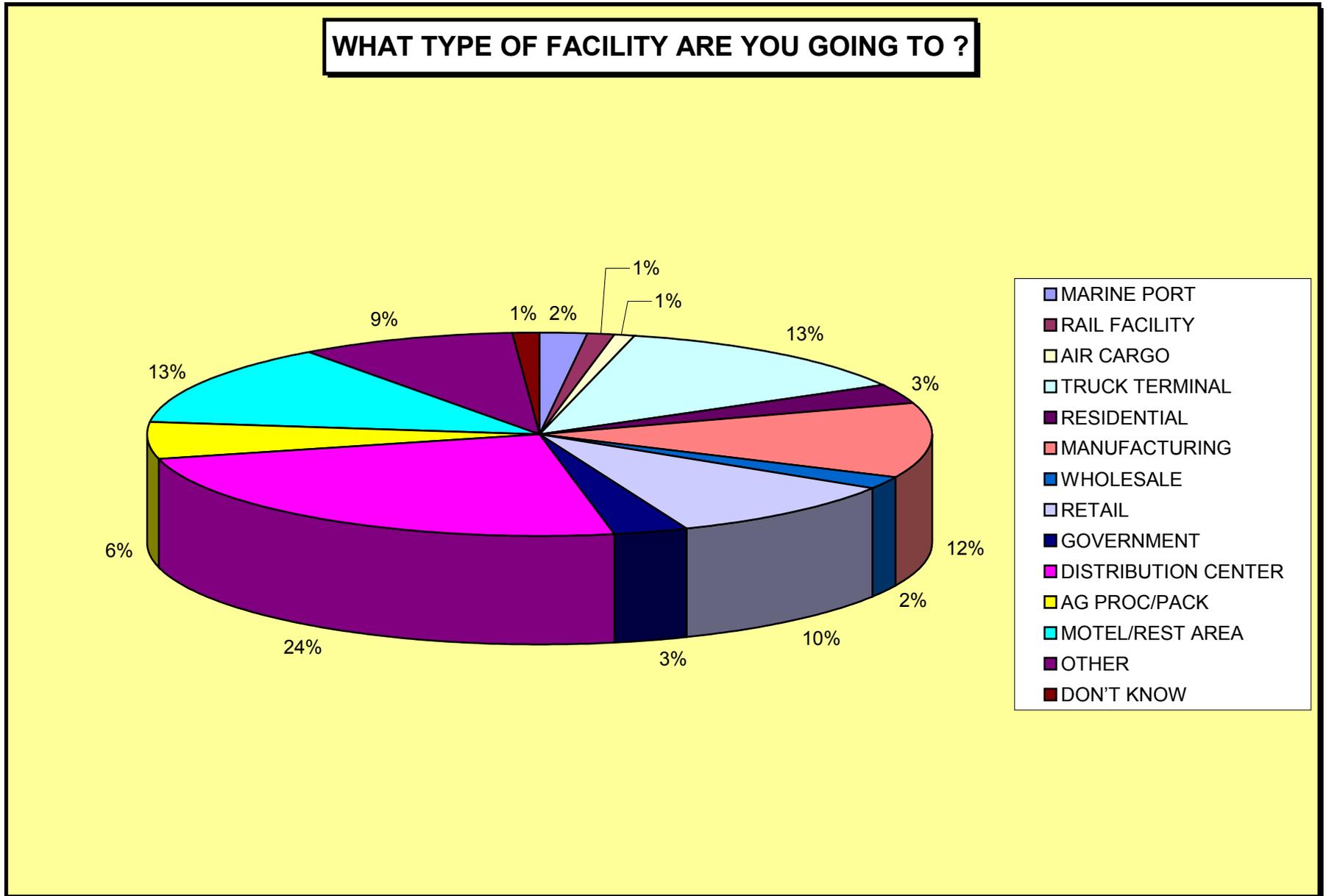


Chart H: Next Stop Activity

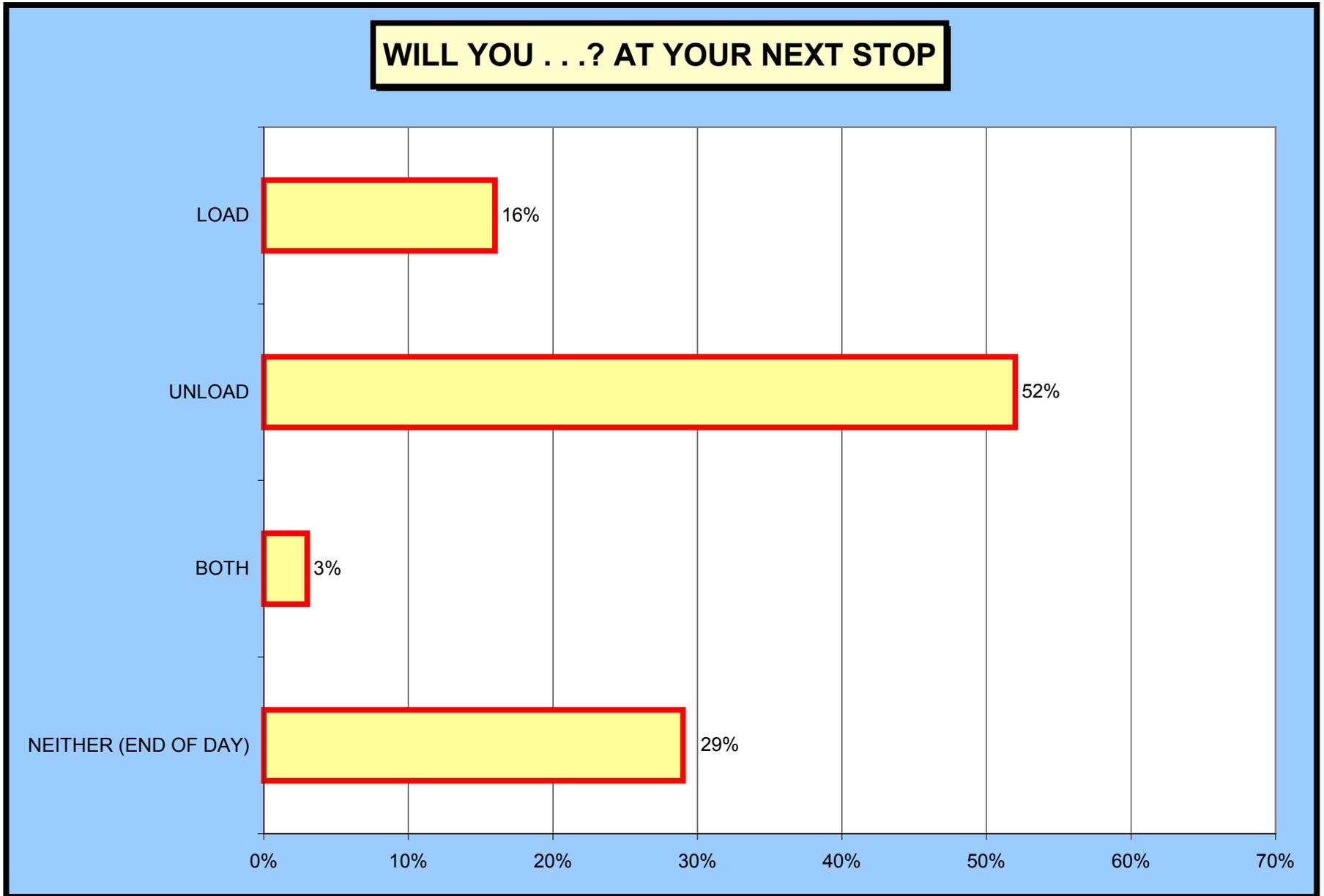


Chart I: Distance Between Last and Next Stops

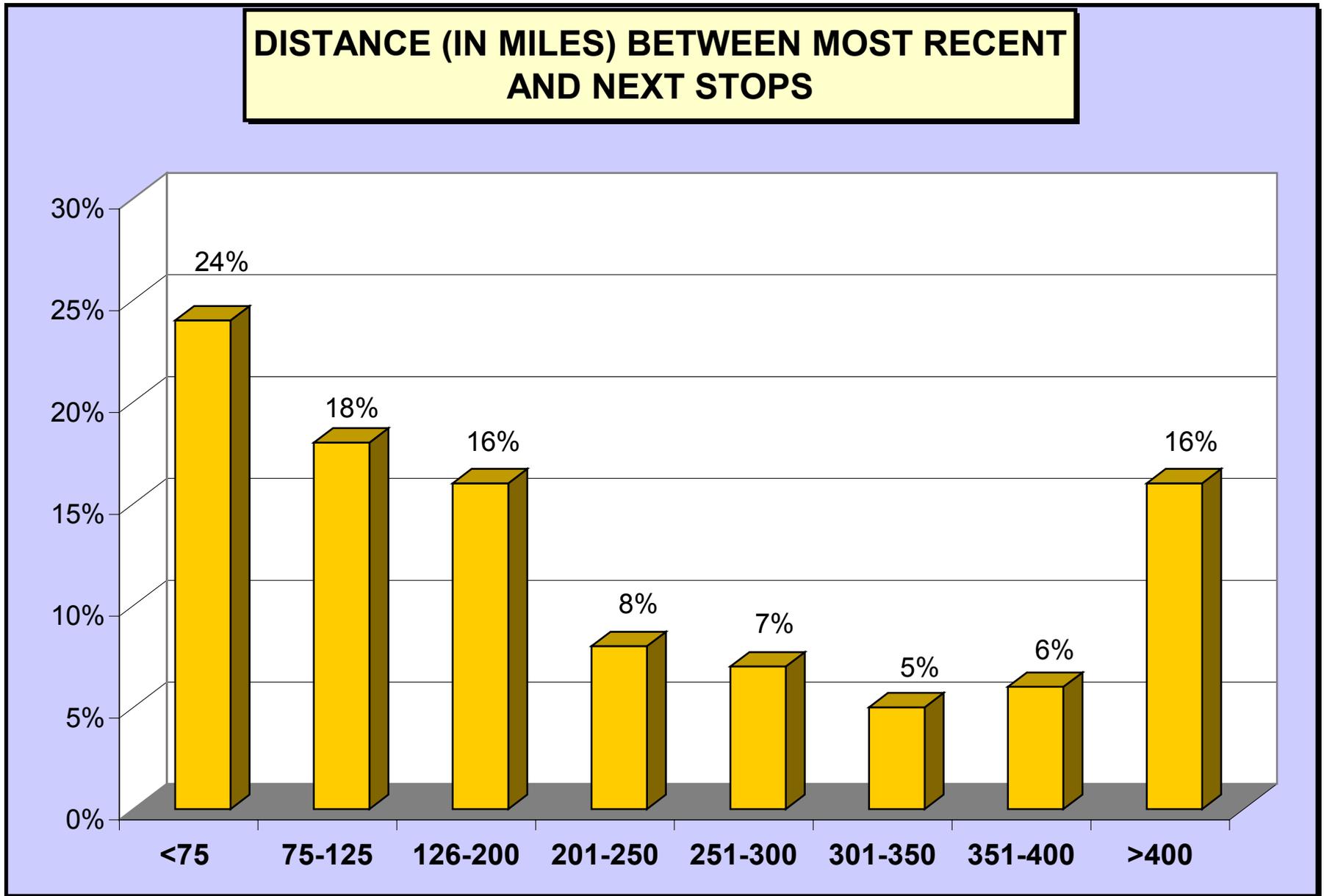
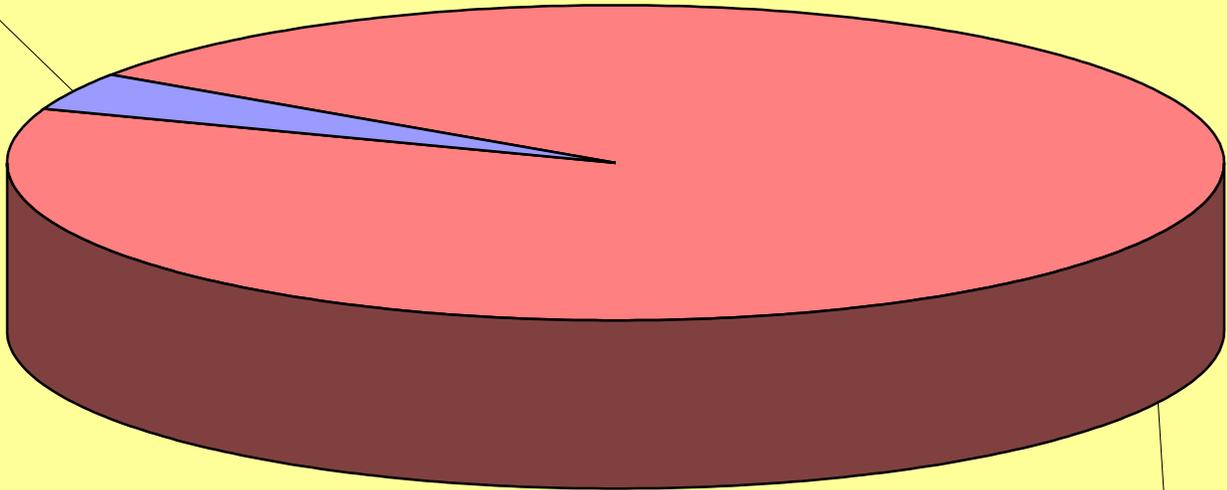


Chart J: Hazardous Materials Signage

**DO YOU HAVE HAZARDOUS MATERIALS SIGNAGE?**

**YES  
4%**



**NO  
96%**

Chart K: Total Number of Stops Today

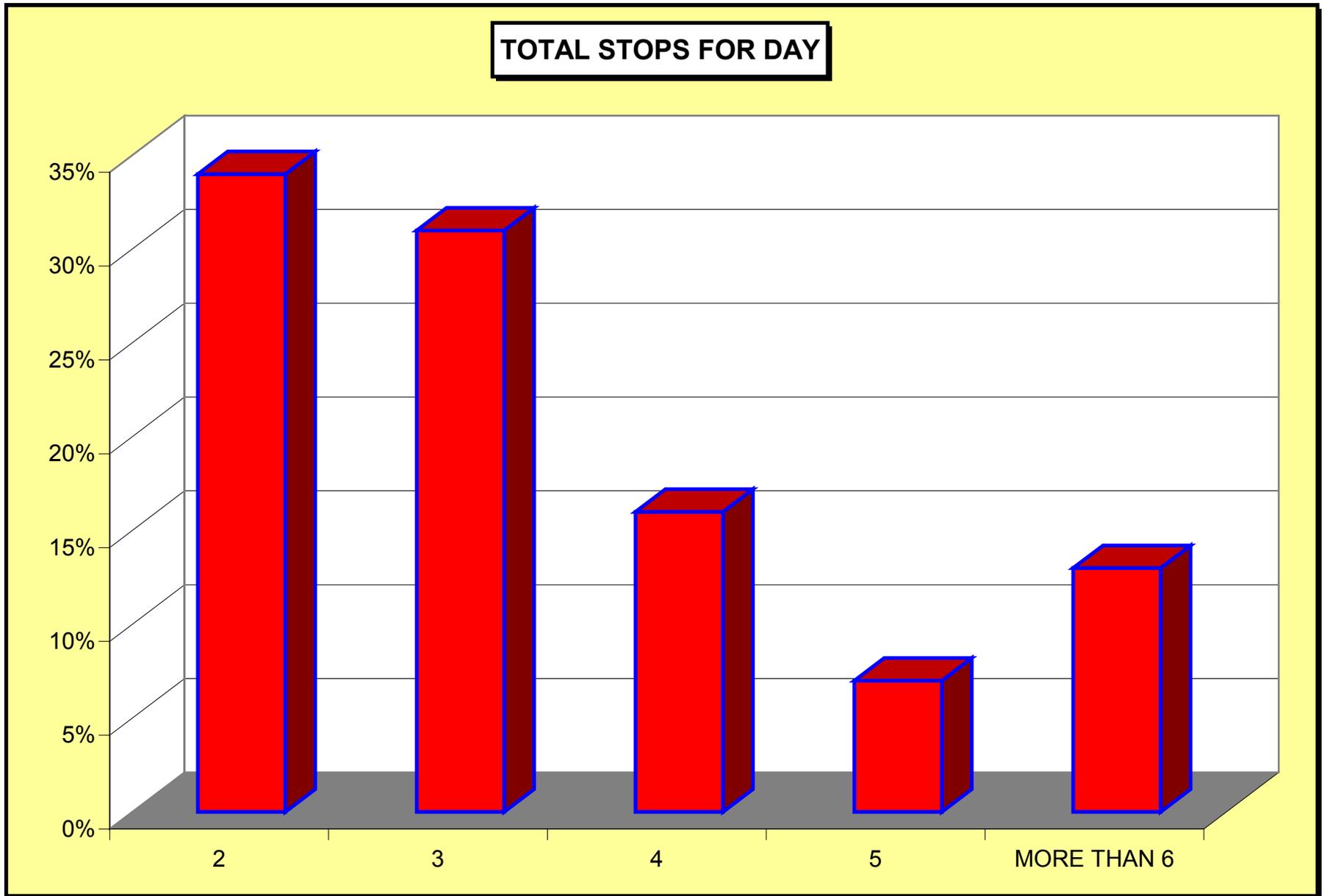


Chart L: Total Miles Driven Today

**TOTAL NUMBER OF MILES DRIVEN TODAY FROM START TO FINISH**

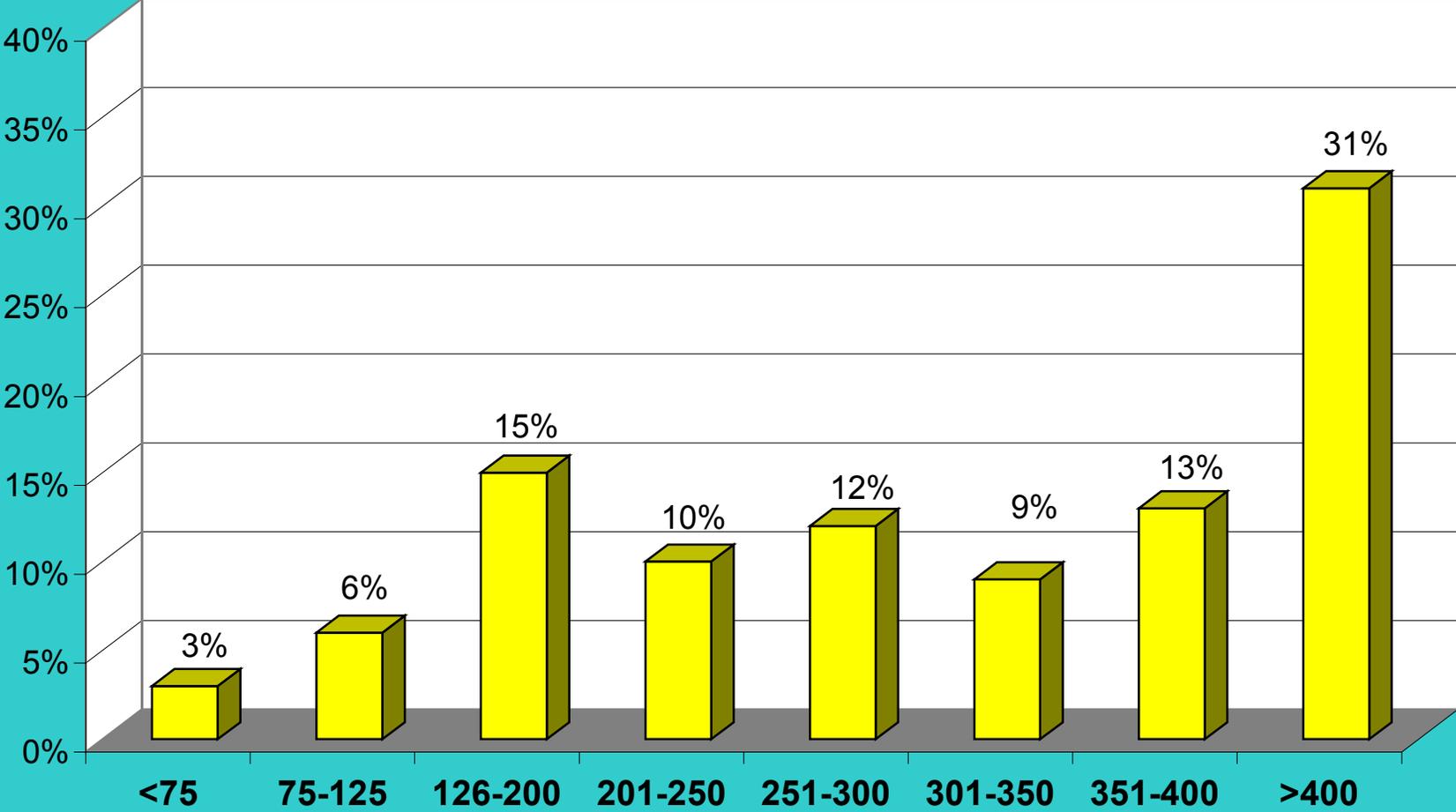
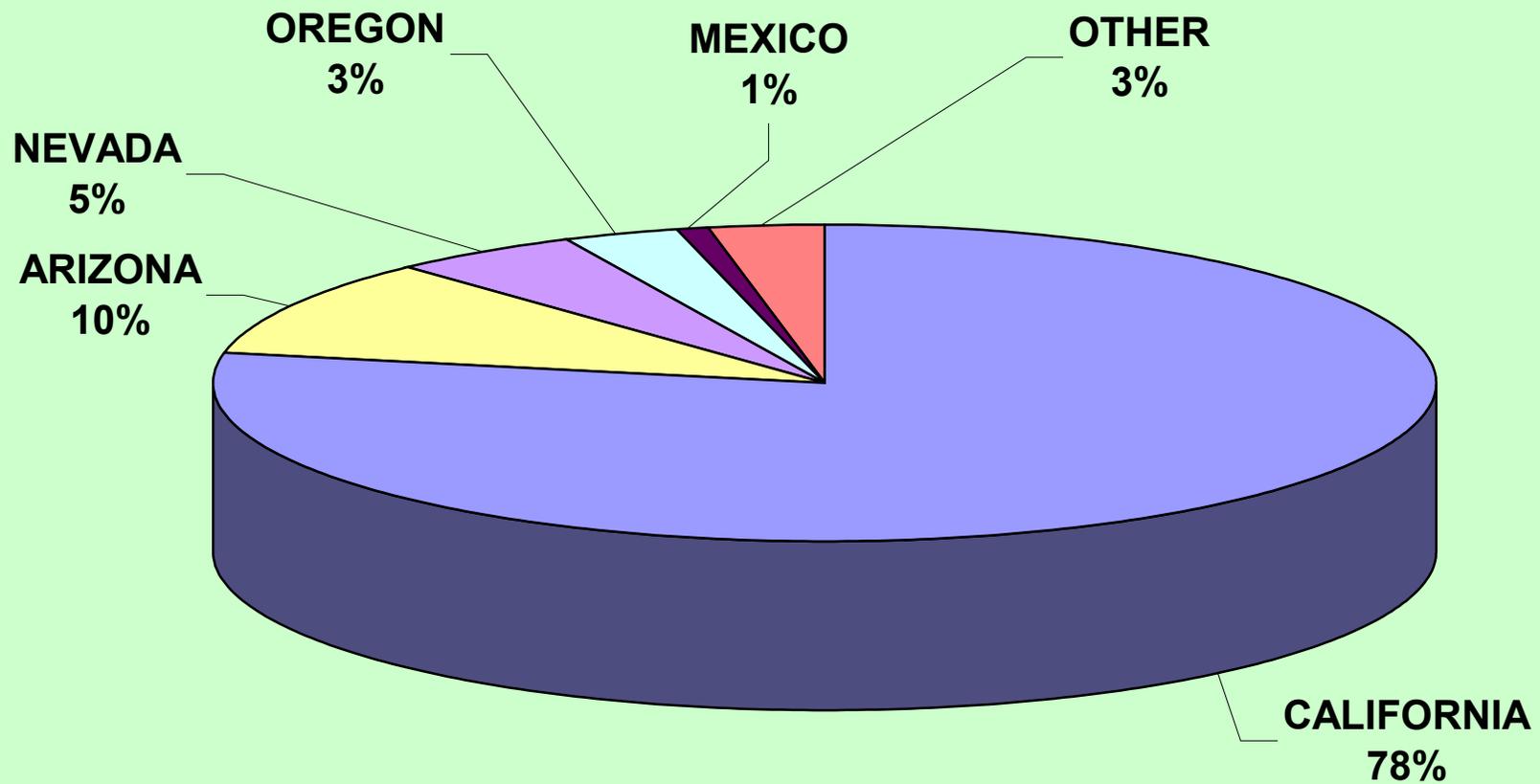


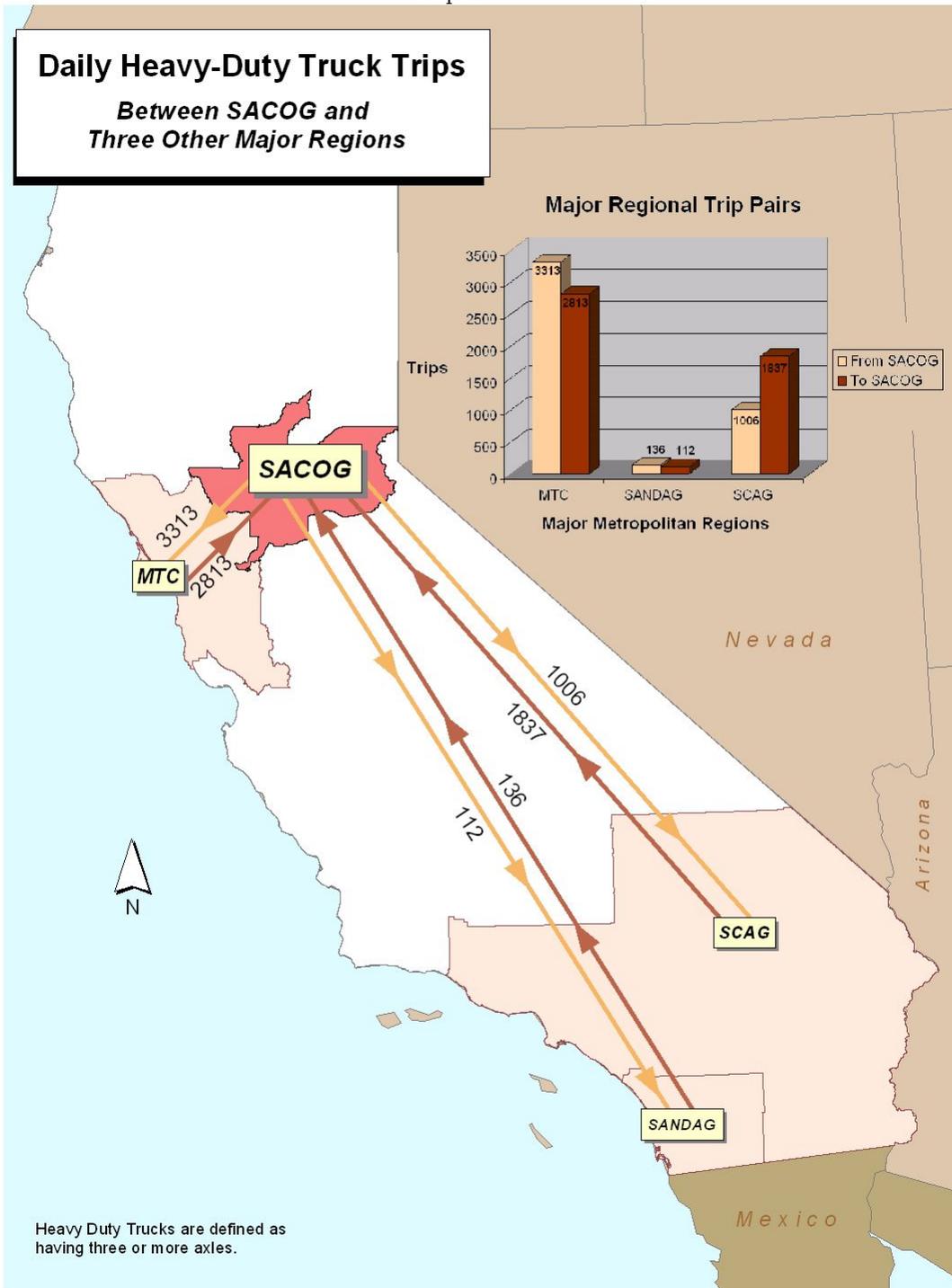
Chart M: State for Last Purchase of Fuel

# STATE FOR LAST FUELING OF TRUCK

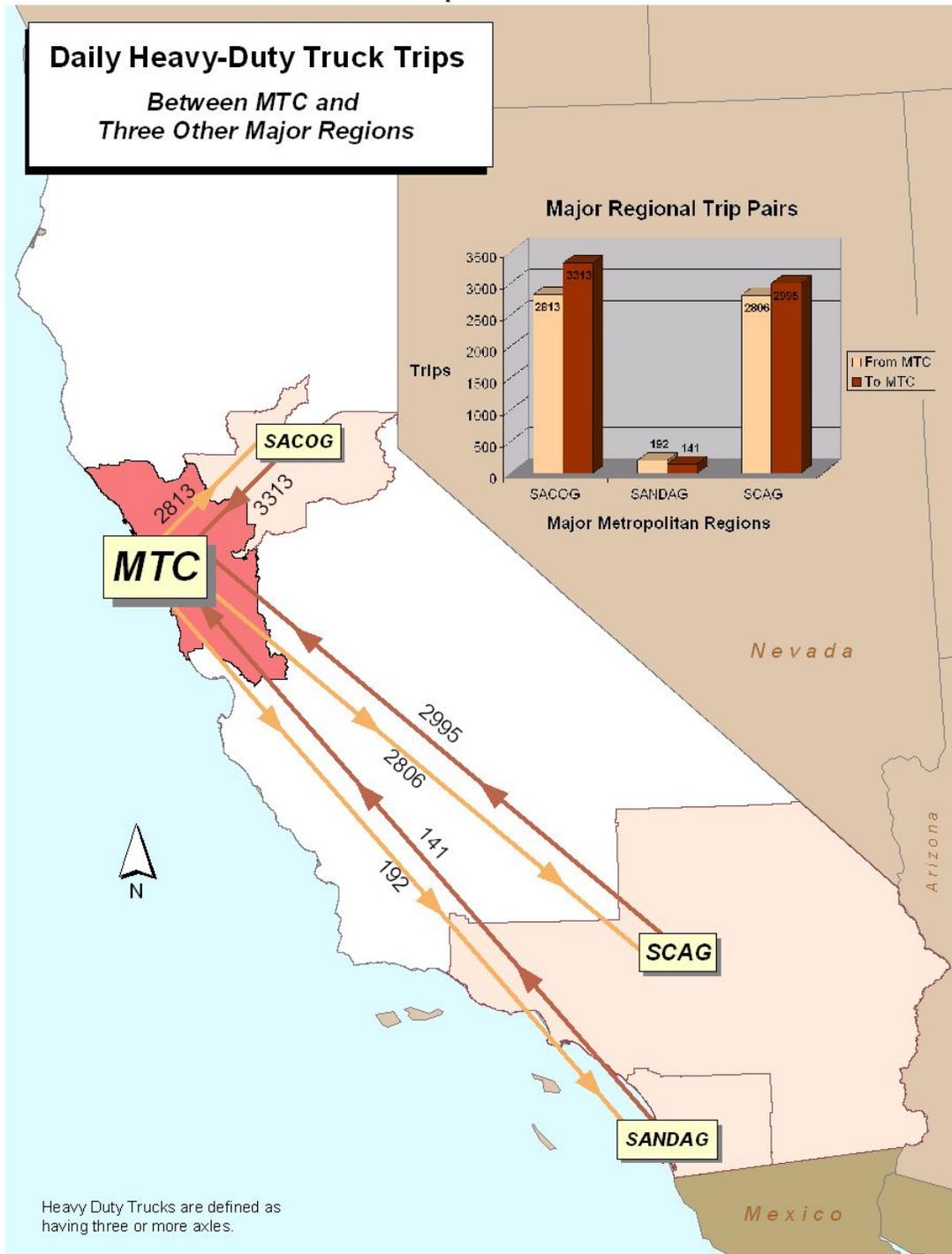


## **Summary of Region to Region Daily Truck Trips, Maps**

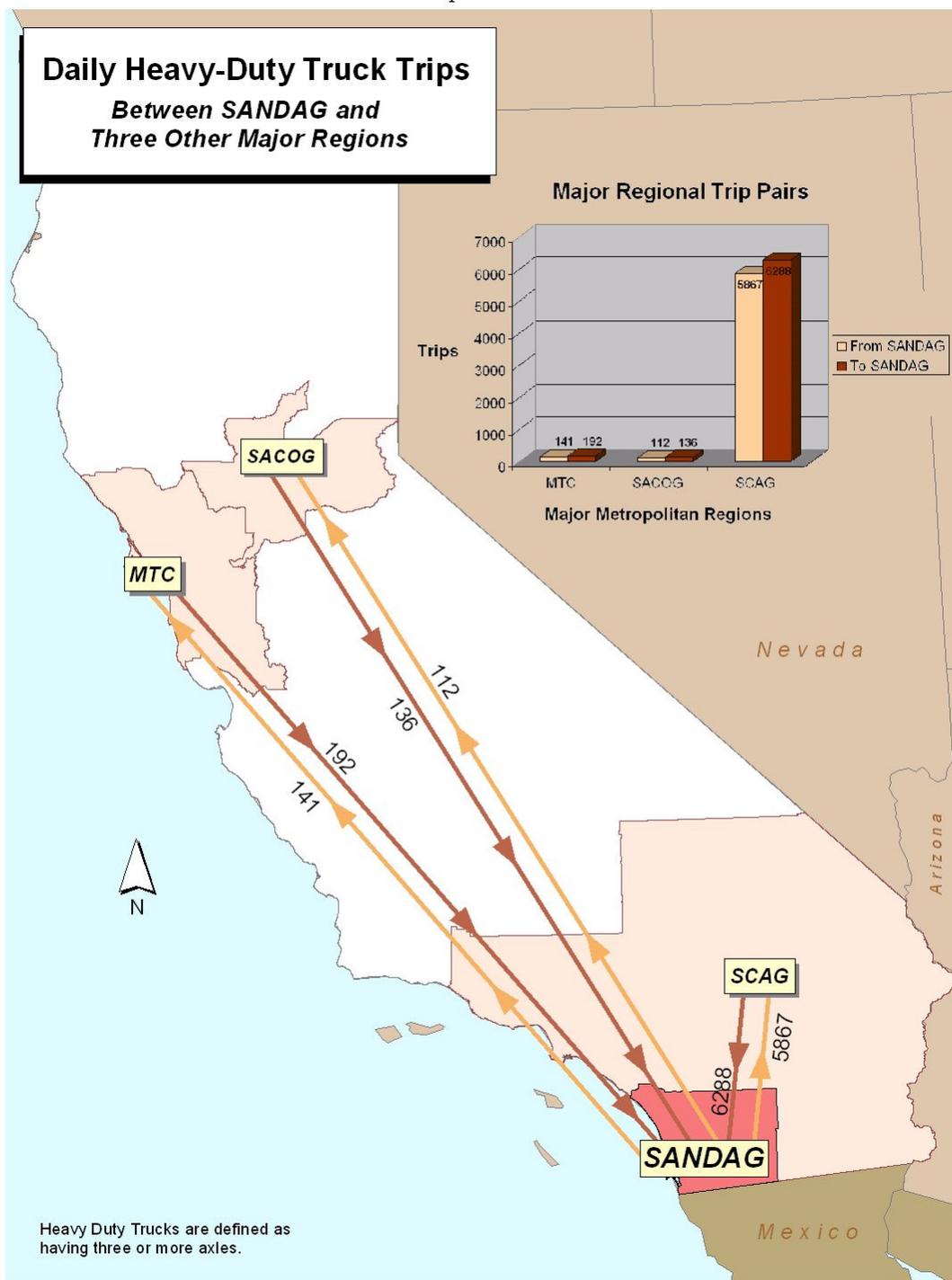
The following four maps, N through Q, illustrate the daily heavy duty truck trips between the four major metropolitan regions in California. The region to region trip pairs as shown in the following maps were derived from the actual truck driver surveys and were expanded using the video tape counts.



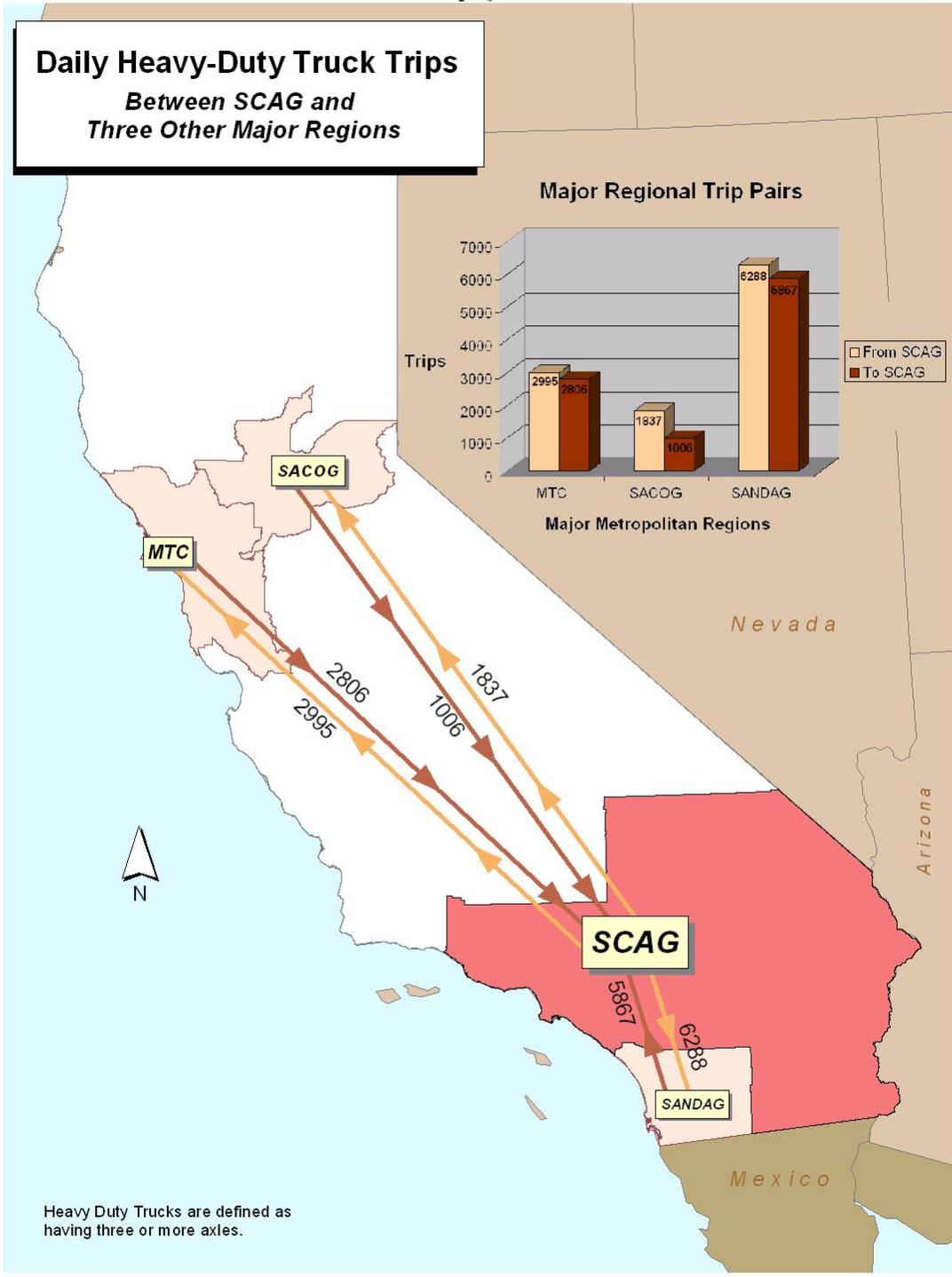
Map O



Map P



### Daily Heavy-Duty Truck Trips Between SCAG and Three Other Major Regions



# **1.0 Introduction**

## **1.1 Purpose and Objectives**

This report documents the findings and procedures of the California Heavy Duty Truck Survey. The overall goal of this project was to collect representative truck travel data for a subsequent forecasting model for statewide interregional heavy-duty truck travel in California. An integral aspect of the project was a literature search and inventory study of freight data survey collection methods. Findings from the search and inventory study were instrumental in identifying a recommended model structure suited to meet objectives of modeling and assessing impacts of line haul or inter-city/ inter-county heavy duty truck movements on California state highways. Additional study objectives included 1) Development of procedures to acquire basic truck travel data 2) Actual conduct of data collection, 3) Collection of data useful to the identification of relationships between economic activity and truck travel patterns, and 4) Collection of data for analysis of commodity flow throughout California.

## **1.2 Project Organization**

### **A) Team Approach**

A project team incorporating a wide range of expertise, practical experience and resources was assembled to achieve the objectives of the study. Project team members included Strategic Consulting & Research (SCR), Cambridge Systematics, K.T. Analytics and ATD Northwest. SCR provided overall project management.

### **B) Model and Survey Design**

Cambridge Systematics conducted model research and design efforts including the Literature Search and Inventory Study and the resulting Recommended Model Design Plan. Survey instrument design and procedures were developed by SCR with the active participation of Cambridge Systematics, K.T. Analytics, and Caltrans.

### **C) Field Data Collection**

Survey data collection took place through assisted interviews of 8,287 truck drivers at the California Highway Patrol weight stations, agricultural inspection stations and roadside rest areas throughout the state. These locations were selected for inclusion in the survey through the Model Design Plan. Truck counts by truck body type were also collected at these sites<sup>1</sup> through videotape technology and used for the survey data expansion process. Survey collection and management was conducted by SCR with video taping activities conducted by ATD Northwest.

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<sup>1</sup> Videotaping was actually conducted on the freeway at the closest possible lighted location so that accurate 24-hour counts on the road could be conducted even when the inspection site is closed.



#### **D) Data Base Management**

Raw survey data was delivered to SCR and incorporated into the database. SCR geocoded approximately 16,500 trip ends from 8,287 field surveys, as well as information on truck type, body type, number of axles, truck weight, commodity carried and other data, as requested by Caltrans. Additionally videotapes documenting truck activity by truck-type, body-type and number of axles were obtained at every survey location.

#### **E) Data Analysis**

The data for the spring wave was expanded from the in-person surveys to total daily truck volume using the video counts for each survey location. Since the video coverage was comprised of a one-tenth of each hour (totaling four hours per day), the raw video counts were multiplied by six to expand the data to a 24-hour day.

## **2.0 Study Approach and Sampling Strategy**

### **2.1 Overall Study Approach**

The primary objective of the project is to provide a database of heavy duty truck travel that includes last stop and next stop data for the trip segment in question, and which is as representative as possible of all heavy duty truck travel throughout the state. To accomplish this, the methodology was comprised of two major components; in person interviews of truck drivers, and video recording of truck traffic at the same locations over a 24-hour period of time.

The in-person interviews of truck drivers covered between eight and sixteen hours based on the relative volume of the sites with the objective of providing the broadest coverage at the heaviest traffic locations. Interviewing at all sites was scheduled for the heaviest volume portion of the day. The data collected in these interviews included last and next stops, types of facilities at both ends, number of axles, truck body type and truck configuration. There were also questions addressing the extent to which the truck was full, cargo being carried, and where the truck last refueled.

The videotaped data provided the number of trucks that passed the target location over the full 24-hour time period. It included only the number of trucks with each one identified by number of axles, body type, and truck configuration.

The interviews provided the distribution of last stops and next stops for the data collection point for the time period when the interviews were collected. This data was then expanded to the full 24 hours using the video data truck counts. The truck counts, which were comprised of 10 minutes per hour (totaling 240 minutes or four hours per day at each location), were expanded to the full day by multiplying by six. The subsequent results that were used for both the last stop / next stop tables and the cross-tabulated data were weighted using this total number of trucks per day (typical Tuesday/ Wednesday/ Thursday). As a result, all data that is presented is in the form of total truck volume on a typical Tuesday, Wednesday or Thursday weekday basis.

### **2.2 Sample Size Requirements**

The sample size required for a sample of heavy-duty truck trips depends on the intended use of the data and the parameter(s) being estimated from the sample. In a typical statistical estimation exercise, the goal of the data collection is to estimate a population parameter(s) with a given degree of precision at a given confidence level. If, for example, the population to be measured is all regional truck trips on an average weekday, variables of interest could include the average payload, or percent of trips that are empty. Calculation of a sample size to estimate a population mean, such as average payload, requires some knowledge of the expected mean and variation of the variable in question. For the California heavy-duty truck survey, the primary intended use of the data is for estimation of truck demand models. Rather than directly estimating a population

parameter, we will be estimating a relationship between the population and some exogenous variable. For example, a trip generation rate is the relationship between employment in a zone and the number of truck trips generating there. The chief data collection concerns thus become collecting enough data to estimate statistically significant model coefficients and avoiding bias in the sample.

With respect to the first data collection concern, a rule of thumb often used in travel demand modeling is that trip generation models require a minimum of 200 observations per stratification to estimate statistically significant coefficients. For example, to estimate a separate trip generation model for each of three vehicle classifications would require at least 200 observations in each vehicle category. Similarly, separate models by commodity category, or special generator type would require 200 observations in each cell.

With respect to the second data collection concern, it is quite possible to estimate “statistically significant” (as measured by the “T” or other statistics) coefficients in travel demand models that are wrong due to bias in the estimation data set. The bias would not usually become apparent until the models are applied and give anomalous results (although one could compare the survey set to national data to assure that it does not stray to far from the national norm). For the California truck survey, avoiding bias means striving to capture and equally represent truck trips with variation in any variable that we think might influence truck travel behavior: geographic location, time of day, type of vehicle, season and so forth.

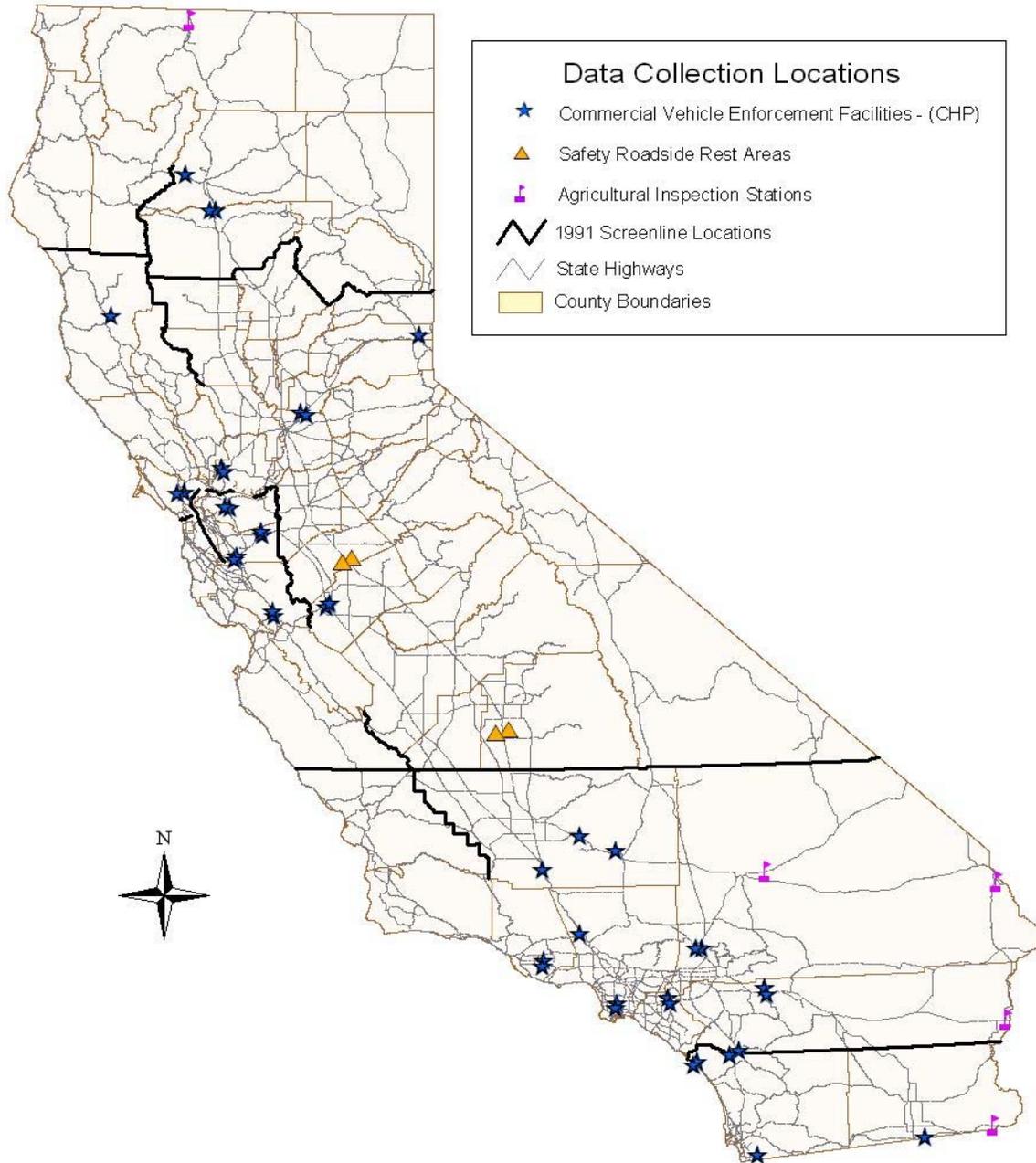
Because we do not yet know the exact form that the truck travel models will take, it is not possible to explicitly calculate the required sample size on this basis. Typically, model development is an iterative process starting with an initial form that is then influenced by the limitations and potential of the data set. However the number of observations projected for this survey (about 7,500) should provide for a good range of model development options.

### **2.3 Site Selection**

Having ensured that the total sample size is likely to be sufficient for the intended application of the data, the project team focused on developing a list of survey sites and data collection procedures to minimize potential bias.

**Figure 1: Interview Site Map**

## Statewide Heavy Duty Truck Travel Survey



Produced by the Statewide Travel Analysis Branch,  
Caltrans Office of Travel Forecasting and Analysis

March 2001

The basic criterion for site selection was to obtain the broadest geographic, time of day and seasonal coverage within the constraints of the available study resources. The constraints included the following:

- ◆ Potential sites for data collection-these were initially limited to CHP and agricultural inspections stations but later expanded to include rest stops,



- ◆ Hours of operation-safety concerns dictate the CHP personnel be present at each interview location and the CHP is only able to provide a certain number of hours for assistance at each site; and



- ◆ The data collection budget.

Given the above criteria and constraints, the project team selected sites by first identifying which locations would give general geographic coverage. Using visual inspection, sites that would capture trips crossing screenlines, trips entering or exiting major metropolitan areas, and trips at the state border were selected. The project team also took into account input received from Technical Advisory Committee members and Caltrans regarding locations that should be included.

These sites were then arrayed by truck AADT as a guide to relative importance and the likely productivity at each site. Several alternative lists of sites were developed with the aim of maximizing geographic coverage and second seasonal variation. Using assumptions regarding labor productivity, it does not appear possible to obtain both sufficient geographic coverage and total coverage of seasonal variation within the given project budget. In other words, it would not be possible to visit each of the recommended sites four times (once for each season). The recommended approach involves obtaining a comprehensive data set for a single season (spring) with seasonal data collection at a limited number of sites.

Three alternative surveying options were designed to assess the ability to provide optimal coverage in the spring and offspring seasons. These included options with 75%, 56%, and 38% for spring, with the balance being distributed to the offspring seasons. It was only with the first option with 75% spring surveying that we were able to achieve a representative sample of statewide heavy-duty truck travel. The other two options resulted in reducing spring coverage beyond the point needed to provide representative coverage. In addition, although options two and three increase off-spring surveying, it is still not sufficient to provide the level of coverage that would be needed to develop independent seasonal models.

## **2.4 Supplemental Data Sources**

The project team has investigated the availability of truck origin-destination data that might be used to supplement the data collected as part of this project, to date only data collected by Caltrans District 11 has been identified as a promising supplemental data source. These data include approximately 2000 survey records collected in Imperial County at Calexico, and in San Diego County at Tecate, Otay Mesa, I-15 at the Riverside County border, and I-5 at the Orange County border, from August through December of 1995. The data collected appear to be largely compatible with the questionnaire designed for this project. With the exception of Tecate, these locations coincide with sites selected for the statewide survey.



## **2.5 Data Collection Methods and Instruments**

As previously discussed, data needs identified to support both truck generation and trip distribution models included 1) vehicle classifications and counts to expand survey data for a wide range of modeling purposes and 2) truck intercept surveys from approximately 7,500 trucks, maximizing geographical coverage and seasonal variation within project constraints. Specifically the following data needs were identified for the truck intercept survey element:

- ◆ Interstate/state route
- ◆ Direction of travel,
- ◆ Date
- ◆ Time of travel
- ◆ Vehicle classification
- ◆ Truck body type
- ◆ Gross vehicle weight estimates
- ◆ Empty vehicle weight
- ◆ Cargo carrying status
- ◆ Commodity carried (by type consistent with SCTG codes for origin and destination)
- ◆ Origin and destination (of surveyed trip segment)
- ◆ Number of loading/unloading stops on the one-way journey and total day of travel
- ◆ Other travel behavior data



Geographically, 32 site locations were selected for surveying including 26 CHP Inspection/Platform stations, 4 Agricultural Inspection facilities and 2 Truck Rest Areas. Of these, 19 were surveyed in both directions of travel and 13 were surveyed in one direction (with the exception of Two Rock which was closed). One direction of travel was surveyed when only one direction of travel was covered by CHP or Agricultural inspection facilities. All 32 sites were surveyed during the spring survey wave, with the exception of Cajon South and Two Rock, which were closed. Additionally, five sites were surveyed during all four seasons, one site was surveyed three seasons, and two sites were surveyed in one season.

**Table 1: Survey Facilities and Completed Survey Counts**

<b>SPRING WAVE</b>			
<b>FACILITY</b>	<b>SURVEYS COLLECTED</b>	<b>FACILITY</b>	<b>SURVEYS COLLECTED</b>
ANTELOPE - EAST	132	KEENE - EAST	104
ANTELOPE - WEST	137	LIVERMORE - EAST	242
BLYTHE - WEST	148	LIVERMORE - WEST	178
CACHE CREEK - WEST	89	NEEDLES - WEST	134
CAJON - NORTH	247	NIMITZ - NORTH	202
CAJON - SOUTH <sup>1</sup>	0	NIMITZ - SOUTH	113
CALEXICO - NORTH	132	OTAY MESA - NORTH	94
CARSON - NORTH	95	PERALTA - EAST	118
CARSON - SOUTH	79	PERALTA - WEST	141
CASTAIC - NORTH	260	RAINBOW - NORTH	160
CONEJO - NORTH	180	RAINBOW - SOUTH	134
CONEJO - SOUTH	164	RAINE - NORTH	97
CORDELIA - EAST	102	RAINE - SOUTH	120
CORDELIA - WEST	126	SAN ONOFRE - NORTH	155
COTTONWOOD - NORTH	113	SAN ONOFRE - SOUTH	180
COTTONWOOD - SOUTH	76	SANTA NELLA - NORTH	70
DESERT HILLS - EAST <sup>2</sup>	160	SANTA NELLA - SOUTH	63
DESERT HILLS - WEST	218	ST. VINCENTS - SOUTH	51
DONNER PASS - WEST	125	TERRA LINDA - NORTH	95
ENOCH - NORTH	117	WALNUT CREEK - NORTH	107
ENOCH - SOUTH	118	WALNUT CREEK - SOUTH	110
GILROY - NORTH	122	WHISKEYTOWN - EAST	99
GILROY - SOUTH	159	WILLITS - SOUTH	87
GRAPEVINE - SOUTH	137	WINTERHAVEN - WEST	140
HORNBROOK - SOUTH	95	YERMO - WEST	105

<b>SUMMER WAVE</b>			
<b>FACILITY</b>	<b>SURVEYS COLLECTED</b>	<b>FACILITY</b>	<b>SURVEYS COLLECTED</b>
CAJON - NORTH	122	DESERT HILLS - WEST	137
CAJON - SOUTH <sup>1</sup>	0	GRAPEVINE - SOUTH	122
CASTAIC - NORTH	117	LIVERMORE - EAST	128
DESERT HILLS - EAST <sup>2</sup>	0	LIVERMORE - WEST	131

<b>FALL WAVE</b>			
<b>FACILITY</b>	<b>SURVEYS COLLECTED</b>	<b>FACILITY</b>	<b>SURVEYS COLLECTED</b>
CAJON - NORTH	82	DESERT HILLS - WEST	111
CAJON - SOUTH	68	GRAPEVINE - SOUTH	145
CASTAIC - NORTH	104	LIVERMORE - EAST	162
DESERT HILLS - EAST <sup>2</sup>	12	LIVERMORE - WEST	63

<b>WINTER WAVE</b>			
<b>FACILITY</b>	<b>SURVEYS COLLECTED</b>	<b>FACILITY</b>	<b>SURVEYS COLLECTED</b>
CAJON - NORTH	64	DESERT HILLS - WEST	76
CAJON - SOUTH <sup>1</sup>	0	GRAPEVINE - SOUTH	74
CASTAIC - NORTH	80	LIVERMORE - EAST <sup>3</sup>	0
DESERT HILLS - EAST <sup>2</sup>	0	LIVERMORE - WEST	59

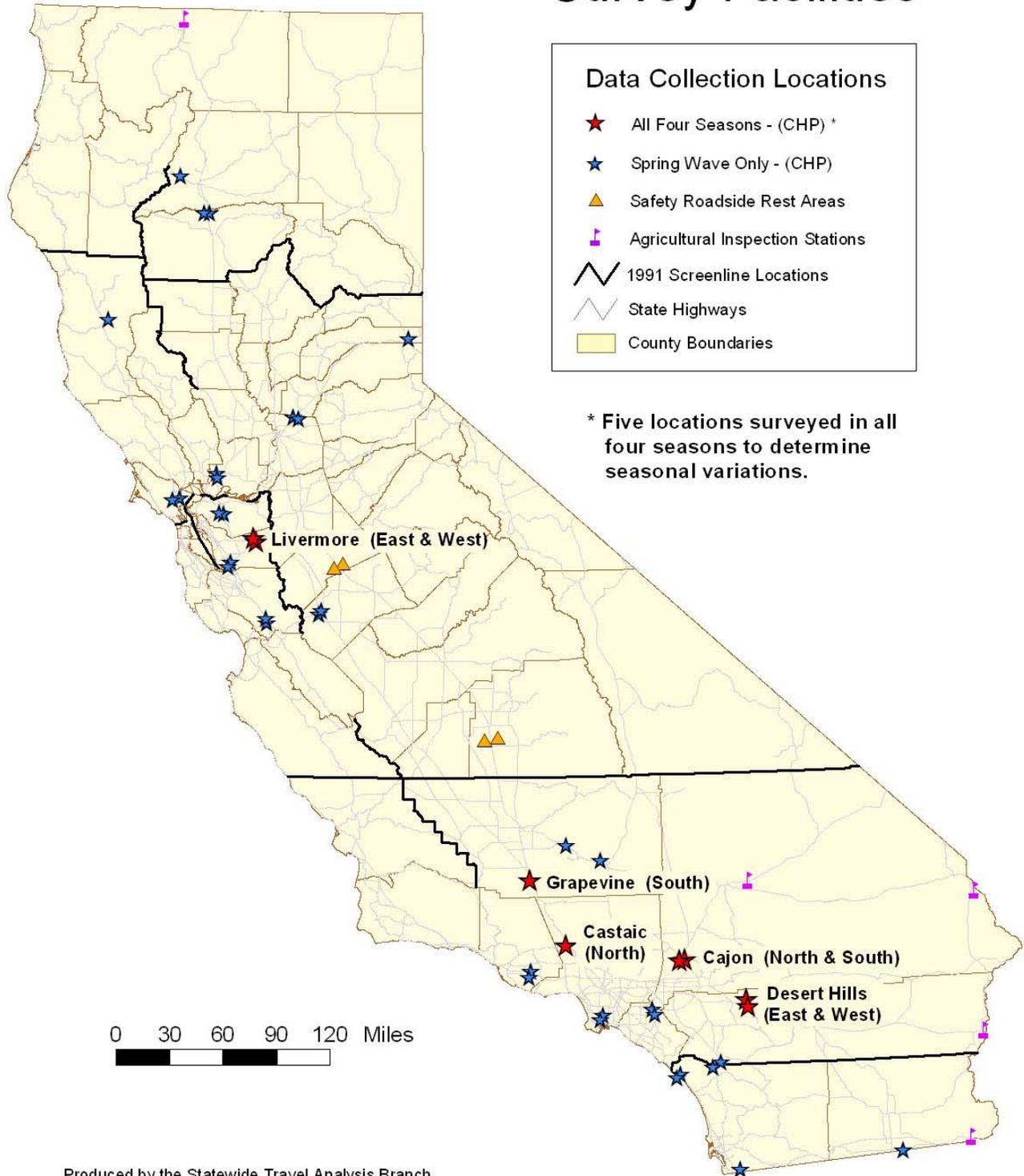
<sup>1</sup> Facility closed with no viable alternative interviewing site

<sup>2</sup> Unsafe interviewing conditions. One hundred sixty (160) surveys were collected during the Spring wave to satisfy all interviewing waves.

<sup>3</sup> Survey data quality was unacceptable. Re-interviewed during the Spring wave to account for shortfall.

Figure 3

# Survey Facilities



Produced by the Statewide Travel Analysis Branch,  
Caltrans Office of Travel Forecasting and Analysis

March 2001

Two methods of data collection were identified as best suited to obtain this information; on-site interviews of truck drivers, and video camera recording. Logistics and instruments for data collection under these methods are discussed below.



### 2.5.1 On-site Interviews

On-site interviewing of truck drivers at the selected survey site locations was easily recognized as the only feasible approach of collecting the detailed information listed above. The development of an efficient and productive survey form and adequate training and procedural materials was more involved.



Two small-scale pre-tests or “convenience” surveys were conducted prior to actual surveying to test the value of preliminary survey instruments and procedures. The pre-tests were conducted under conditions replicating those of the actual survey and numerous changes to both the survey form and procedures were incorporated based on their results.



Once site selections had been finalized, commanders at the selected facilities were contacted to obtain permission for surveying and video taping activities. The commanders were asked to designate a staff member to continuously direct trucks to a designated area (clearly marked by cones) where the surveyors would administer the survey. Commanders were also asked to stagger staff break periods so that surveying activities would not cease during staff lunches and breaks.

A team of two trained surveyors was assigned to administer surveys at each site using the survey instrument shown in the pictures. The more experienced of the team members was also charged with supervisory tasks such as periodically (about every two hours) reviewing survey forms for completeness and logic and dealing with any questions or concerns of facility staff.

On the day of the survey, the survey team was sent to the facility to conduct the surveys. On-route to the facility a team member would enter survey identification numbers on the forms, identifying the order the survey was to be taken, the season, month, day, and location. This was done to conserve time not always available during the survey day.

Upon arrival the team member designated for supervisor tasks would introduce him/herself to the commander and briefly review project forms and productivity targets with the facility staff member assisting with the survey.

Once cones were set up to designate the survey area, the assisting CHP staff member would direct trucks over to the surveyors. When the vehicle had come to a complete stop the surveyors would first request the driver to set his brakes as a safety concern and request the drivers participation in the surveys by reading the salutation on the survey form. The driver would then be asked to shut off the vehicle to reduce the noise level. During the next few moments the surveyor would enter visual information about the truck onto the survey form such as, truck type, number of axles (see figure 2). The survey would then be conducted with the surveyor reading the question exactly as stated on the form, with the following exceptions;

If the driver was uncertain about the vehicle's weight with cargo, the surveyor was directed to prompt by asking if the weight was in certain ranges. The ranges used were 60,000 pounds+, 60,000-33,000 pounds and under 33,000 pounds. These ranges were selected because they are consistent with other major truck studies such as the SACOG commercial vehicle study.

If a trucker would or could not provide an address or two cross streets he was asked for the nearest landmark, a single cross street or a well-known building, and the town name within a quarter mile of his next stop. If this was not offered any information offered was taken down, such as town name.

Due to the uniformity of layouts and truck movements at CHP Inspection facilities the survey area was always set up after the trucks had gone by the weigh scales where vehicle inspections are typically performed. An exception was the Eastbound Desert Hills facility. Space at this facility was very restricted and took place in a wide shoulder adjacent to the exit lanes of the facility.

A very important element of this procedure was the use of a CHP or Agricultural Inspection facility staff member to direct trucks to the surveyors. This was important because it assured a safe process for directing the trucks and because the truck drivers recognized the authority of the CHP or Agricultural Inspection staff. By design all of the selected facilities had large and continuous flows of heavy trucks. It would not have been feasible for anyone other than a uniformed professional staff member to safely or effectively direct the trucks. Coincidentally the procedure may have aided survey participation. Several truck drivers expressed relief that they had not been pulled over for a vehicle inspection and were quite willing to participate in the survey.

**Table 2: California Truck Travel Survey**

1.Survey ID: \_\_\_\_\_ 2.Date: \_\_\_\_\_ 3.Time: \_\_\_\_\_ 4.AM PM 5.Surveyor: \_\_\_\_\_

6.CHP/ AG 7.Facility Name \_\_\_\_\_ 8.Fwy/Route: \_\_\_\_\_

Direction of Travel 9. N E S W 10.Hazardous Materials Signage? Yes \_\_\_\_\_ No \_\_\_\_\_ (CHECK ONE)

11.Truck Type: Single-Unit Single-Unit w/Trailer Single-Trailer Multiple-Trailer 12.Number of Axles: \_\_\_\_\_  
(CIRCLE ONE) (FILL IN)

13.Truck body: Van Container Flatbed Tanker Hopper Open Trailer Specialized/Other  
(CIRCLE ONE)

*- PLEASE SET YOUR BRAKES -*

**Good morning/afternoon. We are conducting a survey of truck travel for the California Department of Transportation. This information will be used to determine improvements to the California State Highway System. The interview should take no longer than three minutes of your time.**

14.Is the truck empty now? Yes \_\_\_\_\_ (skip to #18) No \_\_\_\_\_ (CHECK ONE)

15.What % of total capacity are you carrying now? \_\_\_\_\_% (volume or weight)

16.What is this truck's weight including the cargo? \_\_\_\_\_ (in pounds) If driver is uncertain prompt

17.Would it be over 60,000 pounds? 60,000-33,000 pounds? under 33,000 pounds?

What is the primary cargo being carried? (normally carried if empty) \_\_\_\_\_ 18. \_\_\_\_\_  
SCTG CODE

Where did the truck last stop to load, unload or start the day? 23.Was this your Starting location? Yes \_\_\_ No \_\_\_

19. \_\_\_\_\_ 20. \_\_\_\_\_ 21. \_\_\_\_\_ 22. \_\_\_\_\_  
ADDRESS/CROSS STREETS OR NEAREST INTERSECTION CITY STATE ZIP

24.Did you load \_\_\_ or unload \_\_\_ at this location, or both? \_\_\_ neither (start of day) \_\_\_? (if start- skip arrive time)

What time did you arrive and depart that location? 25.Arrive \_\_\_\_\_ 26.AM PM 27.Depart \_\_\_\_\_ 28.AM PM

29.What type of facility or terminal was that? \_\_\_\_\_ (code letter or write in)  
(port, rail yard, air cargo facility, truck terminal, residential, etc.)

Where will the truck stop next to load, unload, or end the day?

30. \_\_\_\_\_ 31. \_\_\_\_\_ 32. \_\_\_\_\_ 33. \_\_\_\_\_  
ADDRESS/CROSS STREETS OR NEAREST INTERSECTION CITY STATE ZIP

34.Will you load \_\_\_ or unload \_\_\_ cargo at this location, or both? \_\_\_ neither (end of day) \_\_\_?

35.At what time will you arrive there? \_\_\_\_\_ 36.AM PM

37.What type of facility or terminal is this? \_\_\_\_\_ (code letter or write in)  
(port, rail yard, air cargo facility, truck terminal, residential, etc.)

38. What is the distance between the most recent and next stops that we just identified? \_\_\_\_\_ (miles)

39. How many total stops will you make today for loading or unloading including your starting and ending points? \_\_\_\_

40. How many total miles will you drive the truck today from start to finish? \_\_\_\_\_ (miles)

41. In which state did you last fuel your truck? CA \_\_\_\_\_ NV \_\_\_\_\_ AZ \_\_\_\_\_ OR \_\_\_\_\_ MX \_\_\_\_\_ Other \_\_\_\_\_

**THANK-YOU FOR PARTICIPATING IN THE SURVEY!**

**\*\* FACILITY CODES**

Survey Revised 9/1/99

- |                                      |  |                       |                                   |
|--------------------------------------|--|-----------------------|-----------------------------------|
| A. Marine port                       | B. Rail facility                                 | C. Air cargo facility | D. Truck terminal/reload facility |
| E. Residential                       | F. Manufacturing                                 | G. Wholesale          | H. Retail store                   |
| I. Hospital/medical                  | J. Public/government                             | K. Office services    | L. Distribution Center            |
| M. Agricultural Processing/Packaging | N. Truckstop, Roadside rest area, or motel/hotel |                       |                                   |
| O. Other                             | P. Don't know (Do not state)                     |                       |                                   |

## 2.5.2 Video Recording

Video recordings were taken at each site to document truck counts by body type. The tapes were reviewed and truck counts documented for a total of four hours over each sites operational time. For example, a 24-hour facility would have 10 minutes of truck counts by body type documented for each of its 24 hours of operation (10 minutes x 24 hours/ 60 = 4hours). A 12-hour facility would have 20 minutes of tape review for each hour of operation (20 minutes x 12 hours/ 60 = 4 hours). The recordings were conducted seasonally by site to be consistent with the on-site survey schedule.



## **2.6 Geocoding**

The last stop and next stop locations for all 8,287 surveys have been geocoded to latitude and longitude using Microsoft Streets and Trips. There was an extensive cleaning process and the 57% of the data points were geocodable to an exact address, cross-streets, or a California border location. An additional 26% were geocoded to cross-streets using the appropriate freeway or highway and an exit street. Sixteen percent were geocoded to the center of a town or place name location, and 1% could not be successfully geocoded. The cleaning and geocoding processes are described in detail in Appendix I, which is Technical memorandum H.1: Geocoding Process and Results.

Using the geocoded data, each location was aggregated to the county level and subsequently to the regional level. This is the data that was used to provide the county to county and region to region last / next stop trip tables.

## **3.0 Survey Strengths and Weaknesses**

This section presents a discussion of the California Heavy Duty Truck Survey methodology including the strengths and weaknesses of the approach.

### **3.1 Sampling Design and Survey Execution**

Strategic Consulting and Research designed and implemented truck intercept surveys using a roadside interview method to obtain representative travel activity data from truckers using the statewide transportation network. This survey was primarily designed to collect specific trip segment travel behavior information for long-distance truck travel. Useful information for truck travel modeling and planning were obtained using this survey method including last stop and next stop locations, travel distance and times, commodity types, and truck types.

During the truck survey implementation phase, we refined this survey method to obtain additional information about travel behavior in addition to the intercepted trip segment. For example, questions were added to the survey instrument to better understand the truckers' entire trip.

#### **The strengths of this survey method included:**

- ◆ Proven track record for obtaining representative truck travel behavior information;
- ◆ Traditionally have high response rates;
- ◆ Truckers are more amenable to responding to this survey method than other survey methods; and

- ◆ Good truck travel information for travel modeling (distribution modeling, model validation) and transportation planning can be obtained using this survey method.

**The weaknesses to using this survey method included:**

- ◆ Additional data need to be collected from other sources to support modeling, and in particular, truck trip generation; and
- ◆ Limited data were obtained to represent the characteristics of the entire (or total) truck trips.

Other truck data collection methods, primarily both the truck diary/mail back method has proven ineffective in obtaining representative truck travel behavior information compared to the method used for this truck survey. Several areas including Sacramento, Southern California, and Portland, Oregon, have failed to obtain quality and representative data using the truck diary/mail back method. In Sacramento, for example, the California Trucking Association (CTA) led the survey effort that proved to be costly, time consuming, and marginally successful. Many regions throughout the United States have had similar experiences using the truck diary/mail back method.

### **3.2 Data Deficiencies**

The project team considered proven survey methods to collect travel behavior information from truck drivers. However, there were some weaknesses to the data collection methods, primarily as a result of the following constraints:

- ◆ Survey locations were primarily restricted to Agriculture and CHP Inspection Station Locations and in a small number of cases, rest stop locations were also used for surveying;
- ◆ Survey resources were prioritized to collect data during a concentrated period during the typical day (8 to 16 hour periods) rather than the entire 24-hour period; and
- ◆ Survey resources were also prioritized in the spring with less focus on other seasons (summer, fall, and winter).

As a result, the full range of statewide truck travel behavior was not collected in this survey. Many state routes and potentially many California counties are not being represented in the survey process. Other data quality factors include the following:

- ◆ Only a limited number of surveys were collected on roadways entering and exiting California during this survey. The external to internal California truck movement data is currently limited and would need to be enriched with other data sources to support truck modeling.

- ◆ A limited number of survey locations were collected on roadways into and out of major metropolitan areas in California. This weakness has contributed to the need to collect available data from other sources or to collect a fuller sample of inter-regional truck movements as part of ongoing Caltrans activities.
- ◆ Truck last stop and next stop pairs surveyed at one location could have been surveyed at other survey locations. In these instances, the resulting last stop and next stop trips should be processed to identify the number of stations they would be expected to pass by as part of the data modeling process.
- ◆ There will be numerous last stop and next stop pairs for which no crossings of survey locations would be expected. In order to deal effectively with these potentially numerous cases, it will be necessary to increase the survey sites and other survey data (from metropolitan areas, ports, etc.) to obtain estimated trip tables and/or trip ends for modeling.
- ◆ Because only trucks with three or more axles were included in this survey, and empty vehicles were treated differently than loaded vehicles, the truck counts to be used for survey expansion should only include the types of vehicles actually surveyed. Survey expansion should be conducted separately by time of day and vehicle type (and potentially commodity type).
- ◆ Since commodity data and last stop / next stop data was only collected during the more heavily traveled hours of the day, it does not provide a representative sample of how these factors fall out in the low volume, late PM and early AM hours. Since they may be significantly different than peak travel hours, some commodities and stops may be (for example agricultural products) might be under stated, and other categories overstated.

## 4.0 Recommendations

The truck survey intercept approach using roadside interviews implemented for this survey was the most appropriate method to obtain representative long-distance truck travel in the state of California. This method has proven effective in many metropolitan areas and states including Oregon, southern California, and Ohio.

In addition, it was recognized early on in this project that additional, supplementary data would be needed to support this survey effort, and in particular, to support truck travel model development. For example, this intercept data, in addition to the following supplementary data, were specified in the Model Design Plan as requirements to support statewide truck travel modeling and planning in California:

- ◆ Commodity flow data by origin and destination collected by other public agencies or the private sector;

- ◆ Truck classification counts collected at interview locations through videotaping; and
- ◆ Available truck counts and travel behavior information at Port facilities (Oakland, Long Beach) obtained from Port representatives.

#### 4.1 Collect Supplemental Survey Data

Supplementary information could be obtained to enrich the vehicle intercept, commodity flow, and truck classification data already available to Caltrans. The following additional data collection efforts are recommended to support this survey and future truck modeling for California:

- Collect Intercept Data at External Cordons<sup>2</sup>. Conduct additional surveys, using the same intercept survey method on roadways entering and exiting the state of California. This is a weakness of the data collection plan for this project. For example, locations surveyed in this project were limited to CHP and Agriculture Inspection and Rest Stop locations that do not encompass an entire cordon of truck movements entering and exiting the state. This data would be very useful in developing external-to-internal truck models for California. In order to use this method, Caltrans should explore the possibility of using Rest Stop locations and other methods (establish temporary survey stations) to survey truckers coming into and out of the state.
- Collect Intercept Data at Regional Cordons. Collect truck vehicle intercept data using this project's survey method representing regional cordon areas to capture truck trips to and from large regional centers, i.e., Bay Area to/from Sacramento, Sacramento to/from Fresno/Bakersfield. The limitations of this project regarding survey locations has contributed to the need to collect a fuller sample of inter-regional truck movements. As with the external surveying above, we should explore the possibility of using Rest Stop locations and other methods (establish temporary survey stations) to survey truckers coming into and out of the state.
- Design and Collect Freight Distribution Center Surveys. Commodity flow data collected by the U.S. Bureau of the Census includes good information on the ultimate origin and destination of activity but, generally does not obtain commodity flow data related to re-load facility activity. For example, truck activity and commodity flow data at key distribution centers, such as in Stockton, are not represented in the commodity flow databases available in other Divisions in Caltrans. A supplemental survey targeted at key distribution centers in California (Stockton, San Bernardino, Riverside, Otay Mesa) is recommended to better understand truck activities at these re-load facilities that are traditionally under-represented. These surveys can be designed to have dispatchers distribute and collect surveys on travel behavior to truckers entering and exiting these facilities or by having survey interview teams

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<sup>2</sup> Although this was an original objective of the project, this approach was not employed in this study because there was no feasible way to safely conduct interviews at many of these locations where there was no CHP or Agricultural inspection facility or rest area where trucks could safely pull over. If this approach is to be pursued in future data collection efforts, some new method will have to be developed to collect the data in a safer manner.

conduct the surveys at each location. This method has worked in Monterey, California and other locations in the United States.

At the conclusion of this project, we completed over 8,000 truck intercept surveys. These surveys in conjunction with additional data, to be collected in future, can be used to develop statewide truck models for California. The three supplemental surveys identified above are designed to provide Caltrans with additional truck activity to represent truck movements on the entire transportation system including into and out of major distribution truck centers. Supplemental survey questionnaires and sampling plans should use the current heavy duty truck travel survey methods as its foundation with some revision required associated with the Freight Distribution Center Surveys.

#### **4.2 Increase Survey Productivity**

Survey productivity was negatively impacted by the following factors:

- ◆ Inadequate space at CHP Platform stations
- ◆ Facility closures due to freeway congestion and Hazardous Materials alarms
- ◆ Unannounced facility closures due to facility staff reassignments and construction being performed at the facilities

Several CHP Platform facilities have severe space restrictions, which can greatly limit the frequency that surveys can be conducted. As there is not a uniform site layout it is difficult to predetermine which stations will present these challenges or how much they will impede the survey process. If Platform stations are to be utilized for survey purposes they should be visited prior to final planning efforts to realistically assess productivity expectations.

Most facility closures due to freeway congestion and other factors are unforeseen and unavoidable, however, they are predictable. While most “freeway congestion” closures last only 15-25 minutes, they are frequent enough to impact productivity. Hazardous Material alarms can last 2 hours or more and severely effect productivity. A 10-15% reduction factor should be applied to overall productivity expectations to reflect these circumstances.

There were instances where surveyors arrived at a facility that was closed for the day, even though the survey day had been scheduled in advance and confirmed with the station no more than a week preceding the survey date. More coordination with the CHP is recommended to increase the survey productivity. This will be possible if a CHP officer is assigned to guide the survey crews and their activities at each site.

